

CLAIMS

2 What Is Claimed Is:

1. A lancing device for use with a lance, the device comprising:
4 a parallelogram-shaped rack;
a pinion rotatably supported in the rack, wherein rotation of the pinion
6 is coupled to movement of the rack;
a slider-crank system comprising a drive arm coupled to the pinion;
8 and
a lance holder coupled to the drive arm, wherein rotation of the pinion
10 drives the lance holder in linear motion.

12 2. The device of claim 1, comprising a drive wheel coupling the drive
arm to the pinion.

14 3. The device of claim 1, wherein:
16 the parallelogram-shaped rack comprises a proximal acute angle, and a
distal acute angle positioned closer to the lance holder than the proximal acute angle;
18 and
the pinion rotates 180° when moving between the distal acute angle
20 and the proximal acute angle.

22 4. The device of Claim 3, wherein the lance holder moves from a cocked
position to a fired position and wherein the lance holder is in the cocked position
24 when the pinion is positioned at the distal acute angle and in the fired position when
the pinion is positioned at the proximal acute angle.

26 5. The device of claim 3, comprising:
28 a first guide pin fixed relative to the parallelogram-shaped rack; and
a first guide track linearly fixed relative to the pinion, wherein the first
30 guide pin movable interfaces with the first guide track as the parallelogram-shaped
rack moves relative to the pinion, whereby movement of the rack is guided.

6. The device of Claim 5, comprising:

2 a second guide pin fixed relative to the parallelogram-shaped rack,
wherein the rack is positioned between the first and second guide pins; and

4 a second guide track fixed relative to the first guide track, wherein the
pinion is positioned between the first and second guide tracks and the second guide
6 pin movable interfaces with the second guide track as the parallelogram-shaped rack
moves relative to the pinion.

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7. The device of Claim 6, wherein the first and second guide tracks are
10 parallelogram shaped.

12 8. The device of Claim 5, wherein the first guide track is parallelogram
shaped.

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9. The device of Claim 8, wherein the first guide pin is parallelogram
16 shaped.

18 10. The device of Claim 1, comprising a drive spring positioned to move
the lance holder.

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11. The device of Claim 10, wherein the parallelogram-shaped rack is
22 positioned between the lance holder and the drive spring.

24 12. The device of Claim 1 wherein:
the rack comprises four segments;
26 the pinion moves between a first acute angle position and a second
acute angle position;
28 the pinion comprises teeth;
the rack segments comprise teeth adapted to engage the pinion teeth;
30 and
at least two teeth on each segment are modified to reduce chances of
32 the pinion jamming at either one of the first and second acute angle positions.

2 13. The device of claim 1, wherein the pinion rotates 360° as the lance
holder linearly moves from a cocked position to a fired position and back to the
4 cocked position.

6 14. A lancing device for use with a lance, the device comprising:
 a frame comprising a parallelogram-shape rack, wherein the frame is
8 movably supported;
 a pinion rotatably mounted to interface the rack, wherein rotation of the
10 pinion is coupled to movement of the rack; and
 a lance holder movable between a fired position and a cocked position,
12 wherein movement of the lance holder is in response to rotation of the pinion.

14 15. The device of Claim 14, wherein the lance holder moves from the
cocked position to the fired position as the pinion rotates 180°.

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 16. The device of Claim 15, wherein the pinion traverses approximately
18 one-half of the rack as the lance holder moves from the cocked position to the fired
position.

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 17. The device of Claim 14, wherein the parallelogram-shaped rack
22 comprises a first acute angle and a second acute angle and the pinion is positioned
proximate to the first acute angle when the lance holder is in the cocked position and
24 the pinion is positioned proximate to the second acute angle when the lance holder is
in the fired position.

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 18. The device of Claim 17, wherein the pinion rotates 180° as the pinion
28 moves from the first acute angle to the second acute angle.

19. A lancing device for use with a lance, the device comprising:
2 a plate;
a pinion linearly fixed relative to the plate;
4 a frame movable relative to the plate and comprising two rack
segments positioned to form an oblique angle between the two rack segments,
6 wherein the frame is movable between a cocked position and a fired position and the
pinion is positioned to travel along the two rack segments as the frame moves from
8 the cocked position to the fired position; and
a lance holder coupled to movement of the pinion, wherein the lance
10 holder is linearly movable from a retracted position to an extended position as the
frame moves from the cocked position to the fired position.

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20. The device of Claim 19, comprising a spring positioned to move the
14 frame from the cocked position to the fired position.

16 21. The device of Claim 19, comprising a slider-crank system coupling
movement of the pinion to the lance holder, wherein moving the frame moves the
18 lance holder.

20 22. The device of Claim 21, wherein the slider-crank system comprises a
drive arm connecting the pinion and the lance holder.

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23. The device of Claim 22, wherein the pinion rotates 180° as the frame
24 moves from the cocked position to the fired position.

26 24. The device of Claim 19, comprising guide means for guiding
movement of the frame relative to the plate.

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25. The device of Claim 19, comprising slider-crank means for coupling
30 movement of the pinion to the lance holder, wherein moving the frame moves the
lance holder.

26. A lancing device for use with a lance, the device comprising:
2 a frame;
rack and pinion means for moving the frame along a predetermined
4 path from a cocked position to a fired position, wherein the rack and pinion means
comprises one or more rack segments fixed relative to the frame, and a pinion
6 interfacing the one or more rack segments;
lance holder means for holding and moving the lance in linear motion
8 from a retracted position to a predetermined extended position;
means for coupling movement of the frame to the lance holder means
10 such that the lance holder moves the lance from the retracted position to the extended
position as the frame moves from the cocked position to the fired position along the
12 predetermined path; and
means for preventing the lance from extending beyond the
14 predetermined extended position.

16 27. The device of Claim 26, comprising guide means for guiding the frame
along the predetermined path.

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28. The device of Claim 26, comprising spring means for moving the
20 frame from the cocked position to the fired position.

22 29. The device of Claim 28, comprising release means for releasing the
frame from the cocked position and allowing the spring means to move the frame to
24 the fired position.

26 30. The device of Claim 29, wherein the one or more rack segments form a
parallelogram.

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31. The device of Claim 26, wherein the one or more rack segments form a
30 parallelogram.

2 32. The device of Claim 26, wherein the predetermined path along which
the frame moves is non-linear.

4 33. A method of creating a laceration with a lance, the method comprising:
moving a pinion along a predetermined path comprising an oblique
angle;

6 constraining a lance holder to move in a linear motion immediately
prior to reaching an extended position; and

8 coupling movement of the pinion to the lance holder such that the
lance holder is extended when the pinion reaches a predetermined position on the
10 predetermined path.

12 34. The method of Claim 33, comprising stopping movement of the pinion
when the pinion reaches the predetermined position.

14 35. The method of Claim 33, comprising temporarily preventing the pinion
16 from rotating when the pinion reaches the predetermined position.

18 36. The method of Claim 33, comprising guiding a frame comprising the
predetermined path along a predefined track.

20 37. A method of creating a laceration with a lance, the method comprising:
22 moving a pinion along a predetermined path;
coupling movement of a lance holder to movement of the pinion; and
24 preventing the lance holder from extending beyond a predetermined
depth.

26 38. The method of Claim 37, comprising:
28 retracting the lance holder from the predetermined depth; and
rotating the pinion in a single rotational direction, wherein rotating the
30 pinion causes the lance holder to sequentially extend and retract.